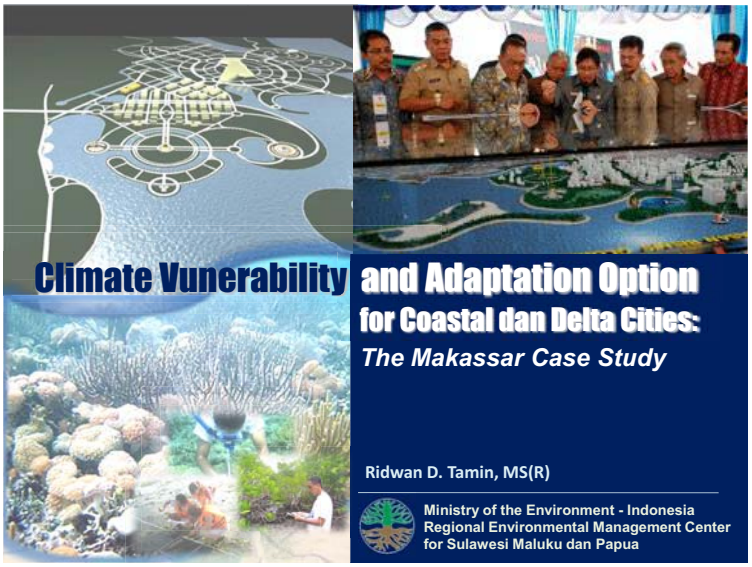

Climate Vunerability and Adaptation Option for Coastal dan Delta Cities:

The Makassar Case Study

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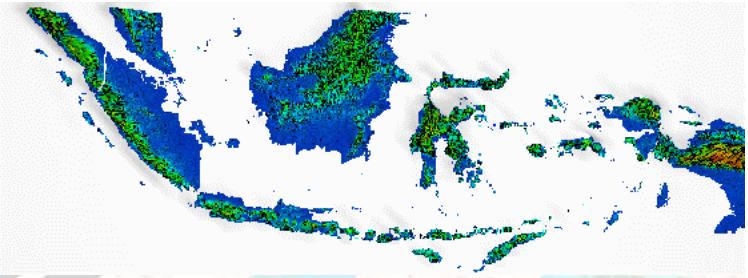
Regional Environmental Management Center
for Sulawesi Maluku dan Papua

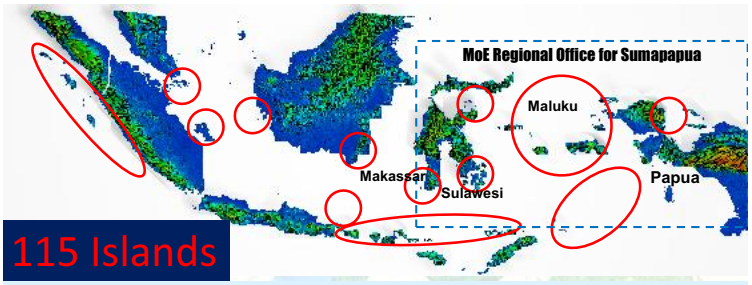
Sea Level Rise Projection in INDONESIA



Year	The area Inundated (km^2)	Sea Level Rise (m)
2010	7,408	0.4
2050	30,120	0.56
2100	90,260	1.1

Source: Susandi, et all. 2008

Sea Level Rises: Certain Regions of the Country Inundated in the Year of 2100



115 Islands

North Sumatera	: Pulau Batu
West Sumatera	: Pulau Sipora, Pulau Bagai Utara, Pulau Bagai Selatan
Riau Islands	: Pulau Singkep, Pulau Sebangka, Pulau Lingga, Pulau Abang Besar, Pulau Panuba, Pulau Benuwa, Pulau Tambelan, Pulau Pinangseribu
Bangka Belitung	: Pulau Belitung
West Kalimantan	: Pulau Karimata ; Kalimantan Selatan : Pulau Laut, Pulau Sebuku
East Jawa	: Pulau Giliraya, Pulau Gili-genteng, Pulau Puteran, Pulau Sapudi, Pulau Raas, Pulau Kangean
Bali	: Pulau Nusa Penida; NTB: Pulau Giligede,Sangeang; NTT: Pulau Solor, Pulau Pantar, Pulau Adonara
Sulawesi Selatan	: Pulau Selayar, Pulau Tanah Pulau Lampea, Pulau Bonerate, Pulau Kaloatoa
Southeast Sulawesi	: Pulau Tukang Bes; Sulawesi Tengah: Pulau Banggai
North Maluku	: Pulau Mangole, Pulau Tubulai, Pulau Obi, Pulau Obilatu, Pulau Damar, Pulau Gebe
Maluku	: Pulau Watubela, Pulau Wetar, Pulau Tanibar, Pulau Babar, Pulau Kai
West Papua	: Pulau Rumberpon, Pulau Gag

Basic Principals for the Environment

Pasal 28 G ayat 1 UUD 1945: "*Every person has the right to pursue happiness, home, and obtain a good and healthy environment and the right to health services*"

Pasal 33 ayat 4 UUD 1945: "***National economy*** *carried out based on economic democracy using the principals of collectiveness, justice efficiency, sustainable, environmentally friendly, self reliance and preserving progress balance and national economic unity.*

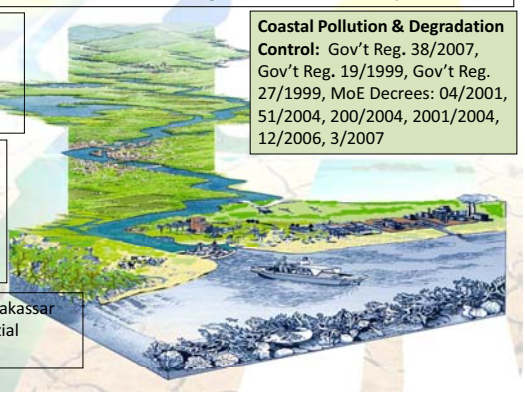
The Government Policy on Coastal Zone: National, Regional and Local

Constitution of 1945, Law 32/2009, Law 26/2007, Law 32/2004, Law No. 31/2004, Law 27/2007, Law 17/2004 → Right on Healthy and Clean Environment &Sustainable Development, Environmental Protection & Management, Spatial Planning, Local Governance, Fisheries, Coastal and Small Island Management, Ratification of Kyoto Protocol

Coastal Protected Area: Law 5/1990, Law 5/1994, Gov't Reg. 68/1998, Gov't Reg. 26/2008, President Decree 32/90

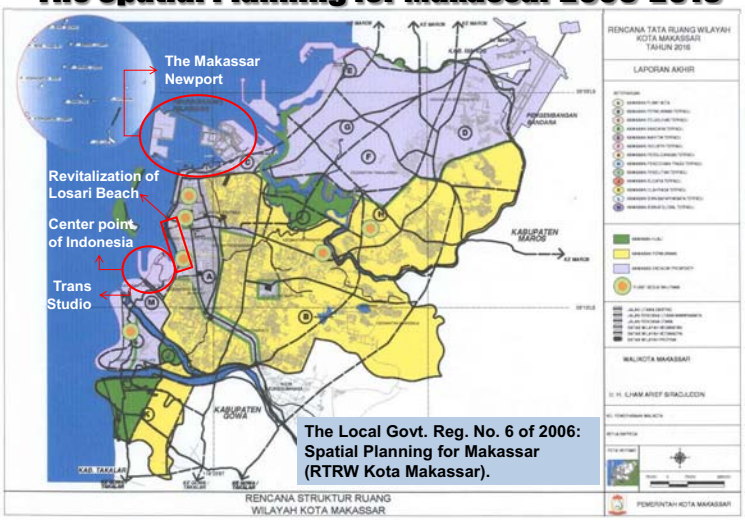
Coastal Pollution & Degradation Control: Gov't Reg. 38/2007, Gov't Reg. 19/1999, Gov't Reg. 27/1999, MoE Decrees: 04/2001, 51/2004, 200/2004, 2001/2004, 12/2006, 3/2007

Coastal Flora-Fauna Preservation & Utilization: Law 7/1999, Law 8/1999, President Decreee 43/1978 & 1/1987 (Cites)



The Local Regulation of Makassar (PERDA) No. 06/2006 Spatial Planning for Makassar

The Spatial Planning for Makassar 2005-2015



The Local Govt. Reg. No. 6 of 2006: Spatial Planning for Makassar (RTRW Kota Makassar).

SLR Impact in Makassar

Sea level rise-SLR is expected to rise by 90 cm in 2100 based on the study: IMPACT EVALUATION OF SEA LEVEL RISE ON INDONESIAN COASTAL CITIES, KOBAYASHI, Hideyuki (2004) in Makassar:

Submerged land	22.9 ha
Impact on population	5,840 household
Impact on buildings	4,168 buildings

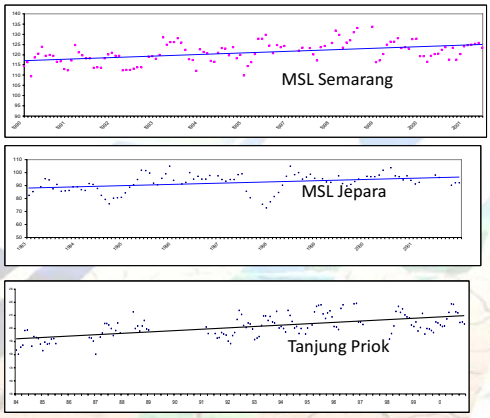
KOBAYASHI, Hideyuki (2004)

Sea Level Rise in Indonesia

Monitoring Station	Average rise in Mean Sea Level (mm/year)	Source
Cilacap	1,30	Hadikusuma, 1993
Belawan	7,83	ITB, 1990
Jakarta	4,38	ITB, 1990
	7,00	Berdasarkan data dari 1984-2006
Semarang	9,37	ITB, 1990
	5,00	Berdasarkan data dari 1984-2006
Surabaya	1,00	Berdasarkan data dari 1984-2006
Sumatera	5,47	ITB, 1990
Panjang, Lampung	4,15	P3O-LIPI, 1991

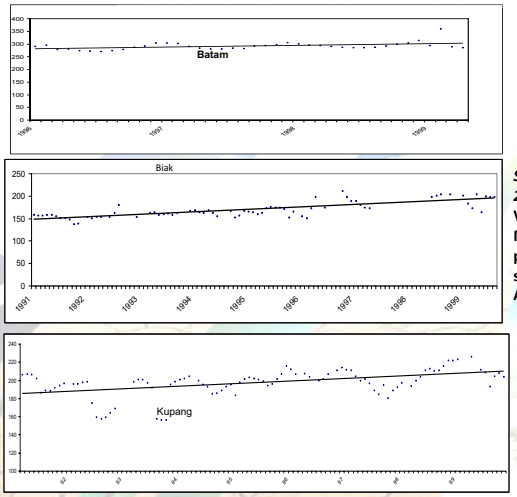
Sumber: MoE, 2007

Sea Level Rise in Indonesia



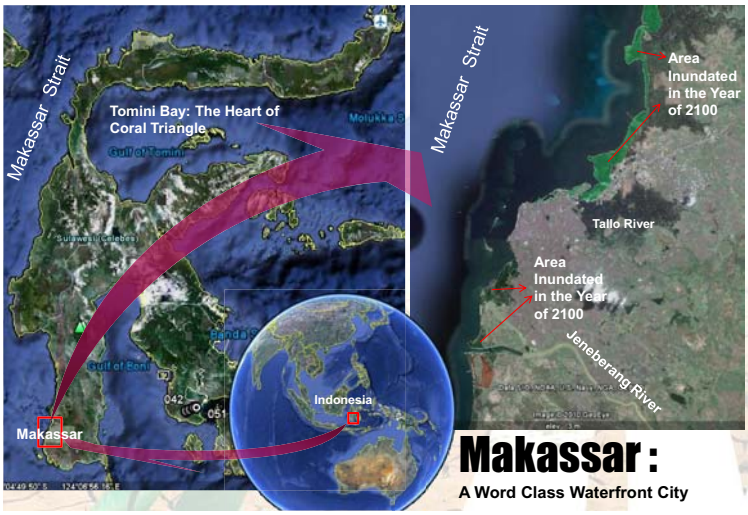
Source: Sutisna S., et al., 2002
Variation and trend for MSL (Cm) from three permanent monitoring station 1984 s/d 2002.
Average rise : 8 mm/year

Sea Level Rise in Indonesia



Source: Sutisna S., et al., 2002
Variation and trend for MSL (Cm) from three permanent monitoring station 1984 s/d 2002.
Average rise : 8 mm/year

A Study Area of Climate Vulnerability and Adaptation Assessment Option for Makassar



Makassar :

A Word Class Waterfront City

Vision of Makassar: A World-Class Waterfont City

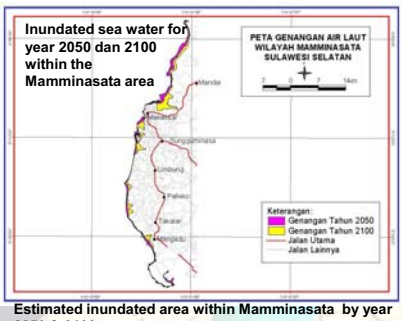
The Center Point of Indonesia: A Megaproject built along the Coastal Areas of Makassar

Revitalization of Losari Beach, Makassar

Climate V&A Assessment: SLR Impact on Makassar and Its Vicinity [MAMMINASATA]

- **Parties Involved**: Experts from Hasanuddin University in collaboration with the MoE Regional Office for Sulawesi Maluku and Papua based in Makassar
- **The Study Area**: The Maminasata area → the regencies of Maros, the city of Makassar, Sungguminasa (Gowa) and Takalar regencies
- **The Objectives**:
  - Delineation of land area inundated by SLR in 2050 and 2100.
  - Assessment of land use and land cover on the inundated area;
  - Economic valuation on the inundated area
  - Formulation of adaptation options

Results of the Study



Estimated inundated area within Mamminasata by year 2050 & 2100

No.	Regency	Inundated Area (ha) 56 cm	110 cm	Total
1.	Maros	1.143	933	2.076
2.	Makassar	908	2.010	2.918
3.	Gowa	32	202	233
4.	Takalar	1.131	1.467	2.598
	Total	3.214	4612	7.825

Source: Amran Achmad (UNHAS) & PPLH Regional Sumapapua, 2009

SLR Impact on Tallo River & its Vicinity, Makassar in the Year of 2050 & 2100

SLR Impact on Tallo River & its Vicinity, Makassar in the Year of 2050 & 2100

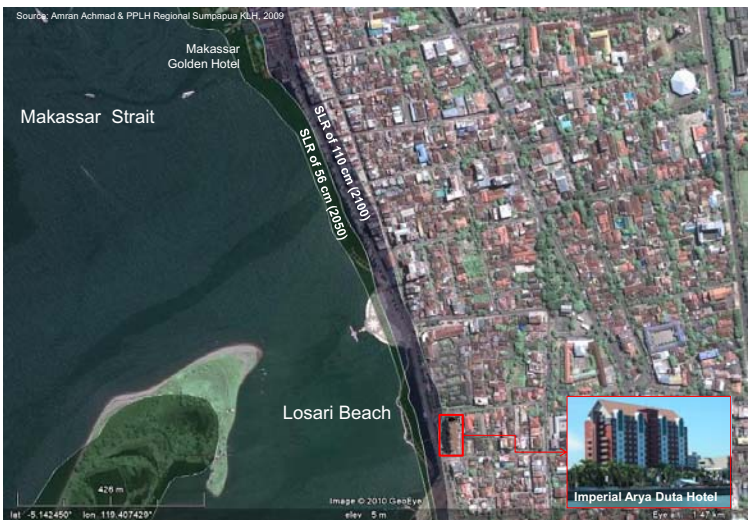
SLR Impact on the Fishermen Village, Makassar in the Year of 2050 & 2100

SLR Impact on the Area along the Makassar Highway & Its Vicinity in the Year of 2050 & 2100

SLR Impact on Poatere Port & Its Vicinity, Makassar in the Year of 2050 & 2100

SLR Impact on Makassar Port & Its Vicinity, Makassar in the Year of 2050 & 2100

SLR Impact on Losari Beach, Makassar in the Year of 2050 & 2100



SLR Impact on Tanjung Bunga, Makassar in the Year of 2050 & 2100

Estimated comunity land loss within the Maminasata area due to inundation by 2100

No.	Land use	Maros Regency		Gowa Regency		Takalar Regency	
		Area (ha)	Price (mill Rp.)	Area (ha)	Price (mill Rp.)	Area (ha)	Price (mill Rp.)
1.	Settlement	8	520	1	65	177	115.050
2.	Fish farm	37	20.350	172	94.600	867	476.850
3.	Rice field	-		-		91	102.375
4,	Mixed catchcrop	-		8	6.400	51	4.080
5.	Submerged area	210	115.500	13	7.150	835	459.250
Total			**136.370**		**108.215**		**1.157.605**

Source: Amran Achmad & PPLH Regional Sumpapua KLH, 2009

Adaptation to Sea Level Rise

- **Relocate**: option chosen if economic and environmental impact are huge, i.e. large floods Makassar with its business centers and infrastructures along the coast would be difficult to relocate..
- **Accomodate**: carried out through reclamation, raising buildings or shifting to aquaculture. Bugis villagers have been developing traditional houses (platform house above land), suitable for adaptation to SLR. Housing developers should be inspired by their traditional technology .
- :**Protect**: *hard structure* such as *breakwater* or *seawalls* and *soft structure* such as in re-vegetation of mangrove or *beach nourishment*. Practice cautiously when "*working with nature*"

Adaptation to Sea Level Rise

- **Planning**: The regional planning process sponsored by the Dept. of Interior (Musrenbang process). Revised spatial plan, designing new coastal protective areas
- **Public Awareness:** Raising awareness on sea level rise and its potential impact, community capacity in dry land agriculture management techniques, community capacity in aquaculture management

Adaptation to Sea Level Rise

Community efforts: Community efforts to avoid inundation during high tides during the western monsoon period

Local government efforts: The local government of Makassar has embarked on adaptation in anticipating sea level rise through rehabilitation and development of sea wall in the Losari Beach area.

This has been carried out also by the Takalar Regency by building seawall along the road to Puntondo, nevertheless it is not constructed to protect against a rise of 110 cm in sea level by 2010.

Lessons Learned and Remaining Challenges [1]

- Modelling for local specific areas using the downscaling method should be developed to precisely deliniate the local area instead of using national predictions.
- A more comprehensive total economic valuation should be carried out based on the more accurate deliniation.
- Integrating the new findings to the existing spatial plan should be carried by local government to minimize the risk and cost
- Develop appropriate adaptation measures involving policy development and local action and introducing co-benefit innovative approaches for adaptation measures.

Lessons Learned and Remaining Challenges [2]

- Shifting the mindset of local stakeholders including policy makers and local communities to digest the issue and translate it to their action.
- By using a moderate prediction we realize the extent of the damage which can occur in the Mamminasata area, let alone the new and extreme prediction findings which are now being reported as regards climate change;
- Other coastal cities should be concerned on their spatial plan based on this simple vulnerability and adaptation assessment. Cities are encouraged to carry out their their own vulnerability and adaptation assessments and integrate the result into their city spatial plan.

Lessons Learned and Remaining Challenges [3]

- Cities and communities in low-lying coastal and delta regions will have to be creative
- Local tradition must also be incorporated in anticipating climate change.
- At the national level, planning is carried out through a series of consultation stages at the local, regional and national level through the Musrenbang process carried out annualy between local governments and the Ministry of Interior.
- To fit the environment agenda in, it is important for environmental officers within the region to consult with the environmental regional office in identifying priorities on environmental issues prior to the Musrenbang process held annualy in April

Thank You

Ministry of the Environment - Indonesia
Regional Environmental Management Center
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